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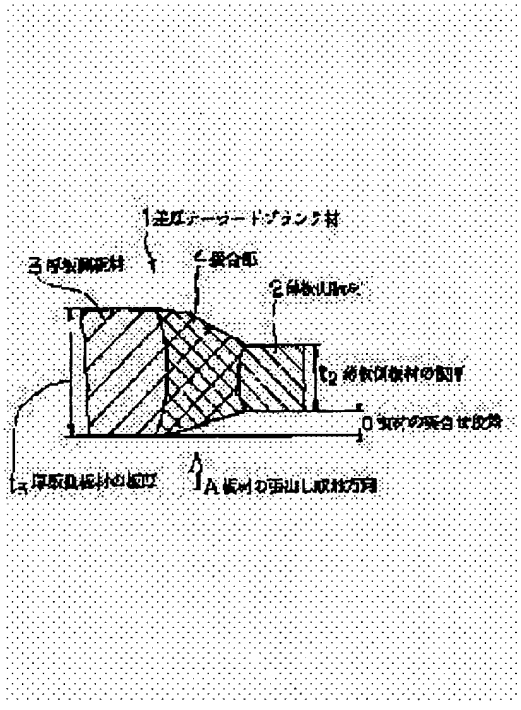
(54) DIFFERENTIAL THICKNESS TAILORED BLANK FORMING METHOD, AND DIFFERENTIAL THICKNESS TAILORED BLANK

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent breakage of a joined part by regulating the butt step of plates on the side where the expansion forming force is applied in the prescribed range to prevent a large shearing force from being applied to the joined part during the pressing in forming the differential thickness tailored blank of a parts in which members of different thickness and different strength are joined with each other and whose expansion forming direction is changed.



SOLUTION: A differential thickness tailored blank 1 comprises a thinner plate 2, a thicker plate 3, and a joined part 4, and the butt step (d) of the plates is formed in the joined part 4. The expansion forming is performed in the direction of the arrow. When the butt step (d) of the plates is increased, the shearing force to be applied to the joined part 4 during the forming becomes excessive leading to the breakage of the joined part, and based on the results of the forming test, the butt step (d) of the plates on the side where the expansion forming force is applied, is in the condition to satisfy the inequality of F3.d/F2.t2<0.5, where t2 is the thickness of the thinner plate 2, F2 is the tensile strength thereof, t3 is the thickness of the thicker plate

3, and F3 is the tensile strength thereof, and the butt position is changed.

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ABSTRACT:

PROBLEM TO BE SOLVED: To prevent breakage of a joined part by regulating the butt step of plates on the side where the expansion forming force is applied in the prescribed range to prevent a large shearing force from being applied to the joined part during the pressing in forming the differential thickness tailored blank of a parts in which members of different thickness and different strength are joined with each other and whose expansion forming direction is changed.

SOLUTION: A differential thickness tailored blank 1 comprises a thinner plate 2, a thicker plate 3, and a joined part 4, and the butt step (d) of the plates is formed in the joined part 4. The expansion forming is performed in the direction of the arrow. When the butt step (d) of the plates is increased, the shearing force to be applied to the joined part 4 during the forming becomes excessive leading to the breakage of the joined part, and based on the results of the forming test, the butt step (d) of the plates on the side where the expansion forming force is applied, is in the condition to satisfy the

inequality of F<SB>3</SB>.d/F<SB>2</SB>.t<SB>2</SB><0.5, where t<SB>2</SB> is the thickness of the thinner plate 2, F<SB>2</SB> is the tensile strength thereof, t<SB>3</SB> is the thickness of the thicker plate 3, and F<SB>3</SB> is the tensile strength thereof, and the butt position is changed.

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The matching level difference d of the plate of the side which it faces forming the difference thickness tailored blank material used as a material of the components from which the plate of a different kind from which board thickness and reinforcement differ is compared, and it joins, and the overhang shaping direction of a plate changes with parts, and sheet metal side plate material is board thickness t2, and it is tensile strength F2 and thick plate side plate material is board thickness t3, and the overhang shaping force requires when it is tensile strength F3 is , $\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$

The formation approach of the difference thickness tailored blank material characterized by joining in a ******** matching location and forming in difference thickness tailored blank material.
[Claim 2] The matching level difference d of the plate of the side which sheet metal side plate material is board thickness t2, and it is tensile strength F2 and thick plate side plate material is board thickness t3 in the difference thickness tailored blank material used as a material of the components from which the plate of a different kind from which board thickness and reinforcement differ is compared, and it joins, and the overhang shaping direction of a plate changes with parts, and the overhang shaping force requires when it is tensile strength F3 is , $\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$

Difference thickness tailored blank material characterized by the matching location changing in the state of ********.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the formation approach of difference thickness tailored blank material suitably used as a material of components that compare the plate of a different kind from which board thickness and reinforcement differ, and join, and the overhang shaping direction of a plate changes with parts, and difference thickness tailored blank material.
[0002]
[Description of the Prior Art] As conventional difference thickness tailored blank material, there is a thing as shown in drawing 5 , for example.
[0003] In this drawing 5 , 51 is the impression configuration sections, such as embossing [in / among the difference thickness tailored blank material 51 / 53 / sheet metal side plate material and / among the difference thickness tailored blank material 51 / 52 / difference thickness tailored blank material and / thick plate side plate material and 54, and / in 55 / the difference thickness tailored blank material 51]. [the joint of the difference thickness tailored blank material 51]
[0004] Moreover, it sets to drawing 6 and an arrow head A shows the overhang shaping direction of the plate at the time of press forming of this difference thickness tailored blank material 51.
[0005] When furthermore explained, this difference thickness tailored blank material 51 was in the condition that the physical relationship in the joint 54 of the sheet metal side plate material 52 and the thick plate side plate material 53 is always fixed, and, in the former shown in this drawing 5 and drawing 6 , the sheet metal side plate material 52 and the thick plate side plate material 53 were what is joined so that the matching level difference of an inside plate may always be set to 0 in the configuration of a hat mold (hat mold).
[0006] The overhang shaping force of the overhang shaping direction of a plate shown by the arrow head A will work at the time of press forming. Further and in a detail About parts other than impression configuration section 55, such as embossing, the overhang shaping force by the overhang shaping direction A of illustration facing up is applied to a plate from the inside in the configuration of a hat mold. About a part with the impression configuration sections 55, such as embossing, the overhang shaping force by the overhang shaping direction A of illustration facing down will be applied to a plate from the outside in the configuration of a hat mold.
[0007]
[Problem(s) to be Solved by the Invention] However, if it is in such conventional difference thickness tailored blank material 51 Since it was what the matching location of the plates 52 and 53 of a different kind is always fixed, and does not change with parts, The part where the matching level difference of the plate by the side of overhang shaping becomes large occurred, when press forming was performed to the part, shearing force worked to the joint, fracture of a joint may be caused and there was a trouble that components cannot be manufactured with a sufficient precision.
[0008]
[Objects of the Invention] This invention is made paying attention to such a conventional trouble. In the

difference thickness tailored blank material used as a material of the components from which the plate of a different kind from which board thickness and reinforcement differ is compared, and it joins, and the overhang shaping direction of a plate changes with parts It aims at solving the above-mentioned trouble by making below into default value the matching level difference of the side which the matching location of sheet metal side plate material and thick plate side plate material is changed, ****s to all parts by the part, and the shaping force requires.

[0009]

[Means for Solving the Problem] The formation approach of the difference thickness tailored blank material concerning this invention It faces forming the difference thickness tailored blank material used as a material of the components from which the plate of a different kind from which board thickness and reinforcement differ is compared, and it joins, and the overhang shaping direction of a plate changes with parts. The matching level difference d of the plate of the side which sheet metal side plate material is board thickness t2, and it is tensile strength F2 and thick plate side plate material is board thickness t3, and the overhang shaping force requires when it is tensile strength F3 is ,

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

It is characterized by making it form in the difference thickness tailored blank material which is suitable as a material of the components from which it joins in a ******** matching location, and the overhang shaping direction of a plate changes with parts.

[0010] Moreover, the difference thickness tailored blank material concerning this invention In the difference thickness tailored blank material used as a material of the components from which the plate of a different kind from which board thickness and reinforcement differ is compared, and it joins, and the overhang shaping direction of a plate changes with parts The matching level difference d of the plate of the side which sheet metal side plate material is board thickness t2, and it is tensile strength F2 and thick plate side plate material is board thickness t3, and the overhang shaping force requires when it is tensile strength F3 is , $\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$

It is characterized by considering as the configuration from which the matching location is changing in the state of ********.

[0011]

[Function of the Invention] By the formation approach of the difference thickness tailored blank material concerning this invention It faces forming the difference thickness tailored blank material used as a material of the components from which the plate of a different kind from which board thickness and reinforcement differ is compared, and it joins, and the overhang shaping direction of a plate changes with parts. The matching level difference d of the plate of the side which sheet metal side plate material is board thickness t2, and it is tensile strength F2 and thick plate side plate material is board thickness t3, and the overhang shaping force requires when it is tensile strength F3 is ,

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

Since it joins in a ******** matching location, and was made to form in difference thickness tailored blank material and the matching level difference of the side which ****s to all the parts of difference thickness tailored blank material, and the shaping force requires becomes the following [default value] The matching level difference of the plate by the side of overhang shaping becomes large, and the fault of ******** in big shearing force is canceled at the time of press forming. Press forming will be performed good, without being accompanied by fracture of a joint. While being formed in the difference

thickness tailored blank material which is suitable as a material of the components from which the overhang shaping direction of a plate changes of a part, the moldability ability of difference thickness tailored blank material improving and the range of applicable components increasing The difference thickness tailored blank material to which the rate of an excellent article also becomes high and its yield improves remarkably will be formed.

[0012] The difference thickness tailored blank material concerning this invention In the difference thickness tailored blank material used as a material of the components from which the plate of a different kind from which board thickness and reinforcement differ is compared, and it joins, and the overhang shaping direction of a plate changes with parts The matching level difference d of the plate of the side which sheet metal side plate material is board thickness t2, and it is tensile strength F2 and thick plate side plate material is board thickness t3, and the overhang shaping force requires when it is tensile strength F3 is , $\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$

Since it has the structure where the matching location is changing in the state of ******** and the matching level difference of the side which ****s to all the parts of difference thickness tailored blank material, and the shaping force requires becomes the following [default value] The matching level difference of the plate by the side of overhang shaping becomes large, and the fault of ******** in big shearing force is canceled at the time of press forming. Press forming will be performed good, without being accompanied by fracture of a joint. While becoming the tailored blank material which is suitable as a material of the components from which the overhang shaping direction of a plate changes, the moldability ability of difference thickness tailored blank material improving and the range of applicable components increasing by the part It becomes the difference thickness tailored blank material to which the rate of an excellent article also becomes high and its yield improves remarkably.

[0013]

[Effect of the Invention] It faces forming the difference thickness tailored blank material used as a material of the components from which the plate of a different kind from which board thickness and reinforcement differ is compared, and it joins, and the overhang shaping direction of a plate changes with parts according to the formation approach of the difference thickness tailored blank material concerning this invention. The matching level difference d of the plate of the side which sheet metal side plate material is board thickness t2, and it is tensile strength F2 and thick plate side plate material is board thickness t3, and the overhang shaping force requires when it is tensile strength F3 is , $\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$

Since it joins in a ******** matching location, and was made to form in difference thickness tailored blank material and the matching level difference of the side which ****s to all the parts of difference thickness tailored blank material, and the shaping force requires becomes the following [default value] The matching level difference of the plate by the side of overhang shaping becomes large, and big shearing force can cancel the conventional fault of ******** at the time of press forming. It becomes possible to perform press forming good, without being accompanied by fracture of a joint. It becomes possible to form in the difference thickness tailored blank material which is suitable as a material of the components from which the overhang shaping direction of a plate changes with parts. While being able to improve the moldability ability of difference thickness tailored blank material and it being possible to increase the range's of applicable components The remarkable effectiveness that it is possible to form the difference thickness tailored blank material whose yield became possible [making the rate of an excellent article high], and improved remarkably is brought about.

[0014] In the difference thickness tailored blank material used as a material of the components from which according to the difference thickness tailored blank material concerning this invention the plate of

a different kind from which board thickness and reinforcement differ is compared, and it joins, and the overhang shaping direction of a plate changes with parts The matching level difference d of the plate of the side which sheet metal side plate material is board thickness t2, and it is tensile strength F2 and thick plate side plate material is board thickness t3, and the overhang shaping force requires when it is tensile strength F3 is , $\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$

Since it has the structure where the matching location is changing in the state of ******** and the matching level difference of the side which ****s to all the parts of difference thickness tailored blank material, and the shaping force requires becomes the following [default value] The matching level difference of the plate by the side of overhang shaping becomes large, and big shearing force can cancel the conventional fault of ******** at the time of press forming. It becomes possible to perform press forming good, without being accompanied by fracture of a joint. It becomes possible to consider as the tailored blank material which is suitable as a material of the components from which the overhang shaping direction of a plate changes with parts. While being able to improve the moldability ability of difference thickness tailored blank material and it being possible to increase the range's of applicable components The remarkably excellent effectiveness that it is possible to offer the difference thickness tailored blank material whose yield became possible [making the rate of an excellent article high], and improved remarkably is brought about.

[0015]

[Example] Next, although the formation approach of the difference thickness tailored blank material concerning this invention and the example of difference thickness tailored blank material are explained, it cannot be overemphasized that this invention is not limited only to such an example.

[0016] Drawing 1 is the cross-section explanatory view showing the definition of the matching location of the different-species plate about this invention.

[0017] In drawing 1 , 1 is the impression configuration sections, such as embossing [in / among the difference thickness tailored blank material 1 / 3 / sheet metal side plate material and / among the difference thickness tailored blank material 1 / 2 / difference thickness tailored blank material and / thick plate side plate material and 4, and / in 5 / the difference thickness tailored blank material 1]. [the joint of the difference thickness tailored blank material 1]

[0018] And while the sheet metal side plate material 2 has board thickness t2 and tensile strength F2, the thick plate side plate material 3 has board thickness t3 and tensile strength F3, and the matching level difference d of a plate is formed in the joint 4.

[0019] When manufacturing the difference thickness tailored blank material 1 as drawing 2 shown one example of the formation approach of the difference thickness tailored blank material concerning this invention, and difference thickness tailored blank material and shown in drawing 2 , the overhang shaping direction A of the plate concerning a joint 4 turns into a direction shown in drawing 3 .

[0020] And in the case of the difference thickness tailored blank material 1 fabricated by the components which form a hat mold (hat mold), it juts out of the inside of a hat mold in the overhang shaping direction of the upward arrow head A, and the shaping force is usually applied to a plate, but in the part of the impression configuration sections 5, such as embossing, it ****s in the overhang shaping direction of the downward arrow head A from the outside of a hat mold, and the shaping force is applied.

[0021] then, about the part except the impression configuration sections 5, such as this embossing About the part which joins plates 2 and 3 as the matching level difference d of the plate in the inside of a hat mold becomes below default value in a joint 4, and has the impression configuration sections 5, such as embossing As the matching level difference d of the plate in the outside of a hat mold becomes below default value in a joint 4, plates 2 and 3 are joined.

[0022] About the default value of the matching level difference d of a plate, it is clearer than an experiment on test piece level.

[0023] On the occasion of the experiment at this time, board thickness t is 1.2mm - 2.3mm, and tensile strength F experimented using 55 kgf(s)/mm mild steel plate of the 2nd class from the 2nd 38 kgf(s)/mm class. And welding by the CO2 laser was carried out to junction again. The ballhead punch stretch forming test performed evaluation of overhang shaping further again.
[0024] This experimental result is shown in drawing 4 . In this drawing 4 , the rate of an excellent article of an axis of ordinate is fabricated by n= 10 to n= 20 in a monograph affair, conducts an evaluation experiment, and is calculating by setting fracture by the joint to NG. Moreover, the matching level difference d by the side of the shaping direction shall be large as the value of a matching location becomes large by matching location =0 about the matching location of an axis of abscissa in the state of the matching level difference d= 0 by the side of the shaping direction.
[0025] Since the shearing force applied to a joint at the time of press forming will become large if the matching level difference d by the side of the shaping direction becomes large as shown in drawing 4 , it becomes the inclination to cause fracture by the joint and for shaping of components to become impossible. And according to the experimental result, it is a matching location.

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

Although it came out and the rate of an excellent article became 100%, when 0.5 was surpassed, the remarkable fall was accepted in the rate of an excellent article. Default value of the matching level difference d of this result to a plate $\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$

It turned out that it is good to become.
[0026] When manufacturing the press-forming article of a hat mold [as / in this example], by the part of the impression configuration sections 5, such as embossing, it works in the direction which juts out from the outside of a hat mold and is shown in the shaping direction A, and the overhang shaping force at the time of press forming is committed in the other part in the direction which juts out of the inside of a hat mold and is shown in the shaping direction A.
[0027] Then, the matching level difference of the side which ****s about all joints and the shaping force requires $\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$

By carrying out, the shearing force applied to a joint at the time of press forming can be suppressed, and fracture by the joint can be controlled now.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] In the formation approach of difference thickness tailored blank material and difference thickness tailored blank material concerning this invention, it is the cross-section explanatory view showing the definition of a matching location (matching level difference d).
[Drawing 2] It is the slant-face explanatory view showing the formation approach of the difference thickness tailored blank material concerning this invention, and the example of difference thickness tailored blank material.
[Drawing 3] It is the side-face explanatory view in which ****ing in the formation approach of the difference thickness tailored blank material concerning this invention, and the example of difference thickness tailored blank material, and showing the shaping direction A.
[Drawing 4] It is the graph which shows the experimental result which supports the magnitude of the matching level difference specified in the formation approach of difference thickness tailored blank material and difference thickness tailored blank material concerning this invention.
[Drawing 5] It is the slant-face explanatory view of the difference thickness tailored blank material by the conventional example.
[Drawing 6] It is the side-face explanatory view in which ****ing in the difference thickness tailored blank material by the conventional example, and showing the shaping direction A.
[Description of Notations]
1 Difference Thickness Tailored Blank Material
2 Sheet Metal Side Plate Material
3 Thick Plate Side Plate Material
4 Joint of Difference Thickness Tailored Blank Material 1
5 Impression Configuration Sections, Such as Embossing
t2 Board thickness of sheet metal side plate material
F2 Tensile strength of sheet metal side plate material
t3 Board thickness of thick plate side plate material
F3 Tensile strength of thick plate side plate material
d The matching level difference of a plate
A The overhang shaping direction of a plate

[Translation done.]

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53/86		53/86	Ａ

審査請求　未請求　請求項の数２　ＯＬ　（全 6 頁）

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(54)【発明の名称】　差厚テーラードブランク材の形成方法および差厚テーラードブランク材

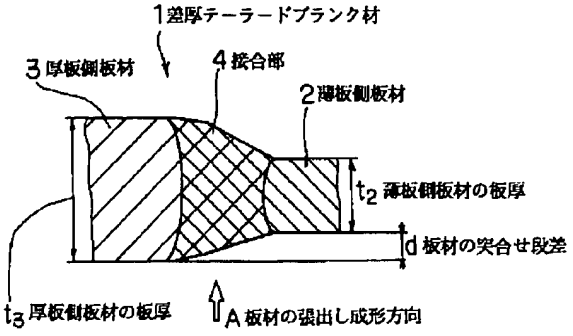
(57)【要約】

【課題】　板厚，強度が異なる異種の板材を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として用いられる差厚テーラードブランク材において、プレス成形時に接合部に大きな剪断力が働くのを防止し、接合部で破断を生じることがないようにする。

【解決手段】　板厚，強度が異なる異種の板材２，３を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として用いられる差厚テーラードブランク材１において、薄板側板材２が板厚t_2でかつ引張強度F_2であり、厚板側板材３が板厚t_3でかつ引張強度F_3であるときに、張出し成形力のかかる側の板材の突合せ段差ｄが、常に、

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

をみたす状態で板材２，３の突合せ位置が変化しているものとする。



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【特許請求の範囲】

【請求項1】　板厚，強度が異なる異種の板材を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として用いられる差厚テーラードブランク材を形成するに際し、薄板側板材が板厚t_2でかつ引張強度F_2であり、厚板側板材が板厚t_3でかつ引張強度F_3であるときに、張出し成形力のかかる側の板材の突合せ段差dが、常に、

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

をみたす突合せ位置で接合して差厚テーラードブランク材に形成することを特徴とする差厚テーラードブランク材の形成方法。

【請求項2】　板厚，強度が異なる異種の板材を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として用いられる差厚テーラードブランク材において、薄板側板材が板厚t_2でかつ引張強度F_2であり、厚板側板材が板厚t_3でかつ引張強度F_3であるときに、張出し成形力のかかる側の板材の突合せ段差dが、常に、

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

をみたす状態で突合せ位置が変化していることを特徴とする差厚テーラードブランク材。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、板厚，強度が異なる異種の板材を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として好適に用いられる差厚テーラードブランク材の形成方法および差厚テーラードブランク材に関するものである。

【0002】

【従来の技術】従来の差厚テーラードブランク材としては、例えば、図5に示すようなものがある。

【0003】この図5において、51は差厚テーラードブランク材、52は差厚テーラードブランク材51のうち薄板側板材、53は差厚テーラードブランク材51のうち厚板側板材、54は差厚テーラードブランク材51の接合部、55は差厚テーラードブランク材51におけるエンボス等のくぼみ形状部である。

【0004】また、図6において矢印Aはこの差厚テーラードブランク材51のプレス成形時における板材の張出し成形方向を示すものである。

【0005】さらに説明すると、この差厚テーラードブランク材51は、薄板側板材52と厚板側板材53との接合部54での位置関係が常に一定の状態であり、この

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図5，図6に示す従来の場合、薄板側板材52と厚板側板材53とは帽子型（ハット型）の形状において内側の板材の突合せ段差が常に0となるように接合されているものであった。

【0006】そして、プレス成形時には矢印Aで示す板材の張出し成形方向の張出し成形力が働くことになり、さらに詳細には、エンボス等のくぼみ形状部55以外の部位については帽子型の形状においてその内側から図示上向きの張出し成形方向Aによる張出し成形力が板材にかかり、エンボス等のくぼみ形状部55のある部位については帽子型の形状においてその外側から図示下向きの張出し成形方向Aによる張出し成形力が板材にかかることになる。

【0007】

【発明が解決しようとする課題】しかしながら、このような従来の差厚テーラードブランク材51にあっては、異種の板材52，53の突合せ位置が常に一定であって部位により変化しないものであったため、張出し成形側の板材の突合せ段差が大きくなる部位が発生し、その部位に対してプレス成形を行った場合に接合部に剪断力が働いて、接合部の破断を引きおこすことがあって部品を精度良く製作することができない場合もありうるという問題点があった。

【0008】

【発明の目的】本発明は、このような従来の問題点に着目してなされたものであって、板厚，強度が異なる異種の板材を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として用いられる差厚テーラードブランク材において、部位によって薄板側板材と厚板側板材の突合せ位置を変化させ、全ての部位に対して張出し成形力のかかる側の突合せ段差を規定値以下にすることにより、上記問題点を解決することを目的としている。

【0009】

【課題を解決するための手段】本発明に係わる差厚テーラードブランク材の形成方法は、板厚，強度が異なる異種の板材を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として用いられる差厚テーラードブランク材を形成するに際し、薄板側板材が板厚t_2でかつ引張強度F_2であり、厚板側板材が板厚t_3でかつ引張強度F_3であるときに、張出し成形力のかかる側の板材の突合せ段差dが、常に、

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

をみたす突合せ位置で接合して部位によって板材の張出し成形方向が変化する部品の素材として適する差厚テーラードブランク材に形成するようにしたことを特徴としている。

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【0010】また、本発明に係わる差厚テーラードブランク材は、板厚，強度が異なる異種の板材を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として用いられる差厚テーラードブランク材において、薄板側板材が板厚t_2でかつ引張強度F_2であり、厚板側板材が板厚t_3でかつ引張強度F_3であるときに、張出し成形力のかかる側の板材の突合せ段差dが、常に、

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

をみたす状態で突合せ位置が変化している構成としたことを特徴としている。

【0011】

【発明の作用】本発明に係わる差厚テーラードブランク材の形成方法では、板厚，強度が異なる異種の板材を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として用いられる差厚テーラードブランク材を形成するに際し、薄板側板材が板厚t_2でかつ引張強度F_2であり、厚板側板材が板厚t_3でかつ引張強度F_3であるときに、張出し成形力のかかる側の板材の突合せ段差dが、常に、

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

をみたす突合せ位置で接合して差厚テーラードブランク材に形成するようにしたから、差厚テーラードブランク材の全ての部位に対して張出し成形力のかかる側の突合せ段差が規定値以下のものとなるので、張出し成形側の板材の突合せ段差が大きくなってプレス成形時に大きな剪断力がはたらくという不具合が解消され、接合部の破断を伴うことなくプレス成形が良好に行われることとなり、部位によって板材の張出し成形方向が変化する部品の素材として適する差厚テーラードブランク材に形成されることとなって、差厚テーラードブランク材の成形性能が向上し、適用可能な部品の範囲が増大すると共に、良品率も高くなって歩留りが著しく向上する差厚テーラードブランク材が形成されることとなる。

【0012】本発明に係わる差厚テーラードブランク材は、板厚，強度が異なる異種の板材を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として用いられる差厚テーラードブランク材において、薄板側板材が板厚t_2でかつ引張強度F_2であり、厚板側板材が板厚t_3でかつ引張強度F_3であるときに、張出し成形力のかかる側の板材の突合せ段差dが、常に、

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$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

をみたす状態で突合せ位置が変化している構造を有するものであるから、差厚テーラードブランク材の全ての部位に対して張出し成形力のかかる側の突合せ段差が規定値以下のものとなるので、張出し成形側の板材の突合せ段差が大きくなってプレス成形時に大きな剪断力がはたらくという不具合が解消され、接合部の破断を伴うことなくプレス成形が良好に行われることとなり、部位によって板材の張出し成形方向が変化する部品の素材として適するテーラードブランク材となって、差厚テーラードブランク材の成形性能が向上し、適用可能な部品の範囲が増大すると共に、良品率も高くなって歩留りが著しく向上する差厚テーラードブランク材となる。

【0013】

【発明の効果】本発明に係わる差厚テーラードブランク材の形成方法によれば、板厚，強度が異なる異種の板材を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として用いられる差厚テーラードブランク材を形成するに際し、薄板側板材が板厚t_2でかつ引張強度F_2であり、厚板側板材が板厚t_3でかつ引張強度F_3であるときに、張出し成形力のかかる側の板材の突合せ段差dが、常に、

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

をみたす突合せ位置で接合して差厚テーラードブランク材に形成するようにしたから、差厚テーラードブランク材の全ての部位に対して張出し成形力のかかる側の突合せ段差が規定値以下のものとなるので、張出し成形側の板材の突合せ段差が大きくなってプレス成形時に大きな剪断力がはたらくという従来の不具合を解消することができ、接合部の破断を伴うことなくプレス成形を良好に行うことが可能となり、部位によって板材の張出し成形方向が変化する部品の素材として適する差厚テーラードブランク材に形成することが可能となって、差厚テーラードブランク材の成形性能を向上することができ、適用可能な部品の範囲を増大することが可能であると共に、良品率を高いものとすることが可能となって歩留りが著しく向上した差厚テーラードブランク材を形成することが可能であるという顕著な効果がもたらされる。

【0014】本発明に係わる差厚テーラードブランク材によれば、板厚，強度が異なる異種の板材を突合せて接合しかつ部位によって板材の張出し成形方向が変化する部品の素材として用いられる差厚テーラードブランク材において、薄板側板材が板厚t_2でかつ引張強度F_2であり、厚板側板材が板厚t_3でかつ引張強度F_3である

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ときに、張出し成形力のかかる側の板材の突合せ段差dが、常に、

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

をみたす状態で突合せ位置が変化している構造を有するものであるから、差厚テーラードブランク材の全ての部位に対して張出し成形力のかかる側の突合せ段差が規定値以下のものとなるので、張出し成形側の板材の突合せ段差が大きくなってプレス成形時に大きな剪断力がはたらくという従来の不具合を解消することができ、接合部の破断を伴うことなくプレス成形を良好に行うことが可能となり、部位によって板材の張出し成形方向が変化する部品の素材として適するテーラードブランク材とすることが可能となって、差厚テーラードブランク材の成形性能を向上することができ、適用可能な部品の範囲を増大することが可能であると共に、良品率を高いものとすることが可能となって歩留りが著しく向上した差厚テーラードブランク材を提供することが可能であるという著しく優れた効果がもたらされる。

【0015】

【実施例】次に、本発明に係わる差厚テーラードブランク材の形成方法および差厚テーラードブランク材の実施例について説明するが、本発明はこのような実施例のみに限定されないことはいうまでもない。

【0016】図1は、本発明に関する異種板材の突合せ位置の定義を示す断面説明図である。

【0017】図1において、1は差厚テーラードブランク材、2は差厚テーラードブランク材1のうち薄板側板材、3は差厚テーラードブランク材1のうち厚板側板材、4は差厚テーラードブランク材1の接合部、5は差厚テーラードブランク材1におけるエンボス等のくぼみ形状部である。

【0018】そして、薄板側板材2は板厚t_2，引張強度F_2を有していると共に、厚板側板材3は板厚t_3，引張強度F_3を有しており、接合部4では板材の突合せ段差dが形成されているものとなっている。

【0019】図2は、本発明に係わる差厚テーラードブランク材の形成方法および差厚テーラードブランク材の一実施例を示すものであって、図2に示すような差厚テーラードブランク材1を製作するとき、接合部4にかかる板材の張出し成形方向Aは図3に示す方向となる。

【0020】そして、帽子型（ハット型）をなす部品に成形される差厚テーラードブランク材1の場合、通常は、帽子型の内側から上向きの矢印Aの張出し成形方向で張出し成形力が板材にかかるが、エンボス等のくぼみ形状部5の部位においては帽子型の外側から下向きの矢印Aの張出し成形方向で張出し成形力がかかる。

【0021】そこで、このエンボス等のくぼみ形状部5

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を除いた部位については、接合部4において帽子型の内側における板材の突合せ段差dが規定値以下となるようにして板材2，3の接合を行い、また、エンボス等のくぼみ形状部5のある部位については、接合部4において帽子型の外側における板材の突合せ段差dが規定値以下となるようにして板材2，3の接合を行う。

【0022】板材の突合せ段差dの規定値については、試験片レベルでの実験より明らかになっている。

【0023】このときの実験に際しては、板厚tが1．2mm～2．3mmでかつ引張強度Fが38kgf／mm^{2}級から55kgf／mm^{2}級の軟鋼板を用いて実験を行った。そしてまた、接合にはCO_2レーザによる溶接を行った。さらにまた、張出し成形の評価は、球頭張出し試験により行った。

【0024】この実験結果を図4に示す。この図4において、縦軸の良品率は、各条件においてn＝10からn＝20で成形して評価実験を行い、接合部での破断をNGとして計算を行っている。また、横軸の突合せ位置に関しては、突合せ位置＝0で成形方向側の突合せ段差d＝0の状態で突合せ位置の値が大きくなるにつれ、成形方向側の突合せ段差dは大きくなるものとしている。

【0025】図4に示すように、成形方向側の突合せ段差dが大きくなるとプレス成形時に接合部にかかる剪断力が大きくなるため、接合部で破断を起こして部品の成形が不可能になる傾向となる。そして、実験結果によると、突合せ位置

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

で良品率は100％となるが、0．5をこえると良品率に著しい低下が認められた。この結果から、板材の突合せ段差dの規定値は

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

となるものとするのが良いことがわかった。

【0026】この実施例におけるような帽子型のプレス成形品を製作する場合、プレス成形時における張出し成形力は、エンボス等のくぼみ形状部5の部位では帽子型の外側から張出し成形方向Aで示す方向に働き、それ以外の部位では帽子型の内側から張出し成形方向Aで示す方向に働く。

【0027】そこで、全ての接合部について張出し成形力のかかる側の突合せ段差を

$$\frac{F_3 \cdot d}{F_2 \cdot t_2} < 0.5$$

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とすることにより、プレス成形時に接合部にかかる剪断力を抑えて接合部での破断を抑制することができるようになる。

【図面の簡単な説明】

【図1】　本発明に係わる差厚テーラードブランク材の形成方法および差厚テーラードブランク材において、突合せ位置（突合せ段差ｄ）の定義を示す断面説明図である。

【図2】　本発明に係わる差厚テーラードブランク材の形成方法および差厚テーラードブランク材の実施例を示す斜面説明図である。

【図3】　本発明に係わる差厚テーラードブランク材の形成方法および差厚テーラードブランク材の実施例において張出し成形方向Ａを示す側面説明図である。

【図4】　本発明に係わる差厚テーラードブランク材の形成方法および差厚テーラードブランク材において規定した突合せ段差の大きさを裏付ける実験結果を示すグラフである。

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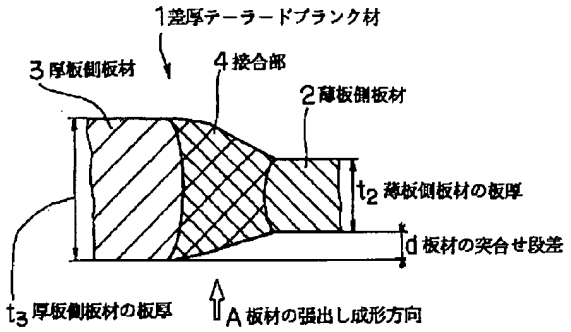
【図5】　従来例による差厚テーラードブランク材の斜面説明図である。

【図6】　従来例による差厚テーラードブランク材において張出し成形方向Ａを示す側面説明図である。

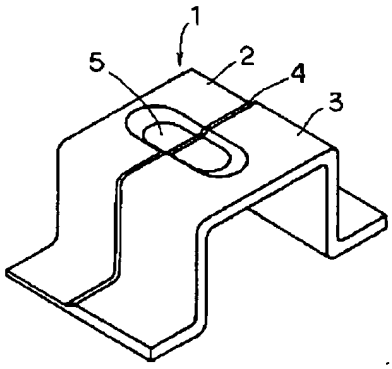
【符号の説明】

1　差厚テーラードブランク材
2　薄板側板材
3　厚板側板材
4　差厚テーラードブランク材１の接合部
5　エンボス等のくぼみ形状部
t_2　薄板側板材の板厚
F_2　薄板側板材の引張強度
t_3　厚板側板材の板厚
F_3　厚板側板材の引張強度
ｄ　板材の突合せ段差
Ａ　板材の張出し成形方向

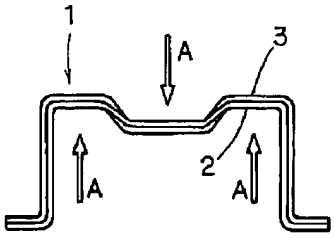
【図1】



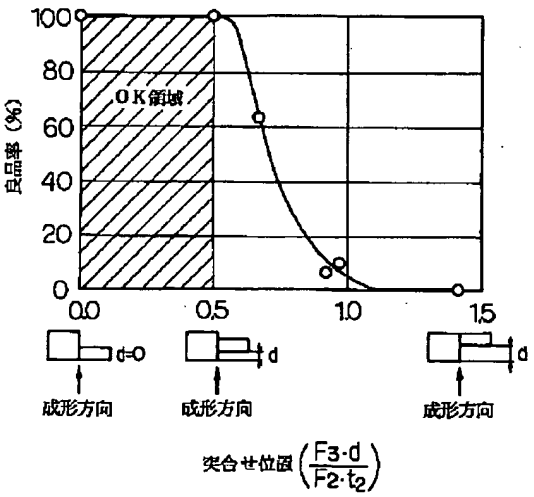
【図2】



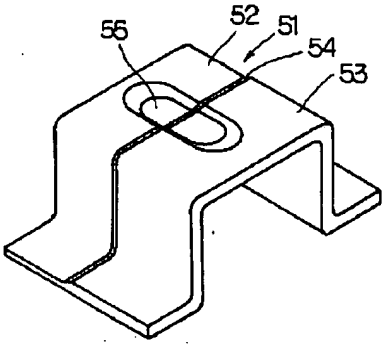
【図3】



【図4】



【図5】



【図6】